NASA ADVISORY COUNCIL

COMMERCIAL SPACE COMMITTEE

NASA Marshall Space Flight Center
Building 4200, Room P-110

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Open Session

Meeting Report

Contents

Meeting Report Prepared by:
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Commercial Space Committee
Ms. Patti Grace Smith, Chair

Committee Members
Present
Dr. Bernard Harris, Jr.
Mr. Lon Levin
Mr. Wilbur Trafton
Mr. Thomas Rathjen, *Executive Secretary*
Ms. Shawanda Robinson, *Administrative Officer*

Guests
Mr. Bob Cabana
Mr. Bob Devlin
Mr. Steve Doering
Mr. Gene Goldman
Mr. Alan Lindenmoyer
Mr. Patrick Scheuermann
Mr. Johnny Stephenson
Ms. Teresa Vanhooser

Mr. Rathjen opened the meeting at 8:00 AM, explaining that this is a public meeting until 2:30, open remotely by Web-ex and telecon.

Opening Remarks

Ms. Patti Grace Smith

Ms. Smith thanked everyone, especially the Center directors, for coming. Yesterday's tour was successful and informative. The committee heard about a number of Space Act Agreements (SAA) that are underway or in work. Administrator Bolden announced senior leadership changes including Robert Lightfoot's move to Headquarters. But, one of the biggest pieces of news was the release of an RFP February 7th inviting industry to compete for the next phase of the Commercial Crew Program.

NASA's FY2013 budget of $17.7 billion is a flat budget, but NASA fared as well as it could have and not as poorly as agencies that lost funding. Administrator Bolden wrote a recent op-ed piece in which he said: "NASA is re-charting its path to Mars." NASA resumed talks with the European Space Agency (ESA) to develop concepts for future NASA missions together with ESA for the scientific and human exploration of Mars. It will take longer than we would like, but Mars is still a part of the future direction. This committee must maintain a sustained approach to the vision and mission of NASA.

Ms. Smith invited meeting participants to introduce themselves.

Briefing: Overview of MSFC's Commercial Space Activities and Plans

Mr. Arthur E. "Gene" Goldman, Deputy Director, Marshall Space Flight Center

Key questions for how Marshall enables commercial space flight with NASA capabilities are:

1. How is the Agency's commercial space strategy message being perceived at the Center?
2. What is the Center doing to promote it?
3. What are the Center's plans for transitioning from the Shuttle and Constellation programs to the new Agency direction that includes commercial space, and how are those plans progressing?
4. How is the Center addressing excess capacity issues?
5. Do you have any concerns or issues with transitioning to the Agency's commercial space strategy?

Marshall's 4 core areas—Space Transportation/Launch Vehicle Technology and Development; Propulsion Systems Technology and Development; Space Systems Technology, Development, and Integration; and Scientific Research—cover 3 areas of NASA's mission. Marshall is known for propulsion and has enabled development of capability that could be used in concert with commercial entities. Marshall's unique capabilities include: Shell Buckling Test, FASTAT, X-ray Calibration Facility, Planetary Lander Test, Wind Turbine Blade, ECLSS Testing, J-2X Nozzle, Solar Sail, and J-2X Testing. They are trying to work with partners to defray the facilities' operating costs.

With the end of the Shuttle and Constellation programs, Marshall went from 3 major programs to 1, the Space Launch System (SLS). To accommodate these changes, Marshall has been reorganizing the staff, reducing the number of contract workers (now about 1700), and demolishing or transferring facilities (e.g., all the human space-flight facilities have to be mothballed or eliminated). They formed the Space Launch Transition Office, and the Flight Programs & Partnerships Office whose focus is commercial partnerships. Space Act Agreements (SAA) have enabled work with commercial entities.

- *Mr. Trafton* asked how they get the word out to the commercial community. *Mr. Goldman* admitted that this is a challenge. They have worked with some contractors for many years, e.g., Boeing. But, it is a fine line between making your available capabilities known and competing with industry, so NASA does not have a catalog that lists what it do.

- *Mr. Levin:* As an organization, does Marshall maintain facilities that commercial entities will come and use, or does it maintain facilities for other needs and want to be sure they are being utilized. *Mr. Goldman:* This is a difficult question because the need to maintain a facility cannot be justified solely because of commercial use. They continually analyze these situations as to who the potential customer is and whether NASA will have eventual uses for the facility.

- *Mr. Cabana:* For most of the facilities at Stennis, people pay to use them. If there is no identified government need to maintain a facility, they are told to eliminate it. The Stennis model is to completely eliminate such facilities, which may be letting someone else have it. However, if the government has no immediate need, but will need it in the future, it would be ideal to share the costs to maintain it. And, if a commercial entity does not need it, it becomes a real problem.

- *Mr. Doering:* We know we do not need everything for future programs, but we do not want to get rid of them—it raises tough questions. *Mr. Goldman:* We look for opportunities for future commercial partnerships, for possibilities to use our capabilities.

- *Ms. Smith* asked how Marshall approaches pricing. *Mr. Goldman*: This is also tough. The government can sell services, but must recover the full cost, so we are often priced too high because, when not using a capability or working with industry, someone has to cover the full cost. Government-to-government sales are much easier, but generally, it's a real challenge. While not making a profit, we are going to charge engineering hours to whomever we do the work for, either on or off site.

- *Ms. Smith*: How do you build innovation into the request? *Mr. Goldman:* We can work with the customer on specifically what they need, and charge them for only what they use. We work within the flexibility we have, although we do not have much. Another problem is that the Air Force and the Department of Defense (DoD) are subject to different laws.

- *Mr. Scheuermann* added, "There's commercial and there's "commercial"." When an activity is purely commercial for commercial's sake, charges are fully reimbursable for whatever we have. *Ms. Vanhooser:* One goal is to be consistent—we want to be sure we price things out the same way each time.

- *Mr. Trafton:* Would Center Directors like to see a change in policy? All agreed that they would. *Mr. Doering* has worked on this in great detail; they propose a NASA Interim Directive (NID) or a NASA Policy Directive (NPD) that will allow NASA to charge less than cost (e.g., charge market rates) for things if we are to make NASA an alternative, e.g., leasing. Industry can depreciate

office space rates to accommodate the local economy and write the rest off as a loss; NASA can't do that—it has to charge the same rates regardless of the market and economy, which sometimes prices NASA out. Most of the major companies know the difference between rates that fluctuate with the economy and the stable rates of a federal site, but the concept is difficult for new commercial companies.

- *Mr. Cabana:* At the same time, we have to make sure we are not competing with a commercial endeavor. If we have excess capacity and facilities we should be able to find a way to get it to them easily. *Mr. Doering:* This is a constant argument. Sometimes we may have to charge full rate for unused space, so it stays empty and we get nothing. However, if we could charge half the rate, then it might be rented. NASA needs legislation to enable this sort of flexibility.

- *Dr. Harris:* Why can't NASA sell assets and make a profit? We must change policies that prohibit that. *Mr. Goldman:* Some things fall under "enhanced leasing," but we have restrictions within NASA, and legislation to prevent NASA from using the provision extensively. *Mr. Doering:* We have capability through an enhanced utilization lease (EUL) authority, but there's no way someone will pay double the rate, and we cannot defer so much cost that it is lower than market cost, because federal authority prevents the government from competing with commerce.

- *Mr. Scheuermann:* We have had the policy since the Space Act of 1968, but its interpretation varies with the Center. Also, commercial business decisions cannot wait for the government process to grind out, and we need to embrace the commercial ethic of speed. *Mr. Cabana* agreed. We can't give an answer until the question has been through all the hoops and approvals.

- *Dr. Harris:* SAA take too much time. *Mr. Goldman:* Part of the problem is the volume of SAA being submitted for approval, and part is what constitutes competition. *Mr. Cabana:* In addition, companies have played Centers against each other. We as an Agency should be consistent in dealing with commercial companies so there is an even playing field.

- *Mr. Stephenson:* We are not concerned with standard rates, but standard content. *Mr. Goldman:* The rate for a facility at Stennis vs. a comparable rate at Marshall may be different. The overhead rate is one NASA doesn't do a good job of standardizing. Each facility has unique capabilities. Under full-cost accounting, the price gets higher, so we have to figure out how to deal with this infrastructure across the Agency.

The National Institute for Rocket Propulsion Systems (NRPS) is intended to be the focal point of ability to solve problems with commercial space endeavors. SLS is a

large program, and Marshall needs commercial partnerships to be able to succeed. In sum, Marshall has adjusted the size of its workforce, technical capabilities, and facilities footprint to align with the Agency mission. Marshall is supporting numerous commercial efforts and collaborations across government agencies through a variety of agreements, and Marshall is actively managing its capability, health, and size to deliver on current and future missions.

Supporting Commercial Partnerships—Ms. Patricia Vanhooser, Flight Programs and Partnerships Office

Marshall has over 200 active SAA that leverage Marshall's unique experience in propulsion, space systems, science, and operations capabilities. The Flight Programs and Partnerships Office wants to ensure the transfer of technology with other government agencies and commercial partners, and in so doing maintains close connections with the Technology Transfer Office, with the Office of Science, Ecosystems and Communities (OSEC), and with the Science Office.

Commercial partnerships benefit the commercial partner, but also benefit us by helping NASA keep abreast of new technologies, use facilities, and enhance knowledge and skills. We get money from the Commercial Orbital Transportation Services (COTS) Program Office and the Commercial Crew Program (CCP) Office, and NASA gives money to commercial companies to do their work. If the SAA is reimbursable, we are getting funding from the commercial partner for the support and services. We have been working with COTS for several years, providing engineering and project management support to help them review data packages and participate in technical reviews. Currently under COTS we partner with Space-X, Orbital, and Aerojet. We also provide support through CCP and are currently working with SpaceX, ATK, Blue Origin, and Excalibur, among others.

These partners have come to us with Reimbursable SAA to have us perform tasks for them. The 2 lines of authority and costing are clearly divided. They know the kind of capabilities we have. We have provided materials and welding expertise, engineering analysis, and wind tunnel tests. An Umbrella Space Act Agreement is a good mechanism, and it is easy to attach annexes for specific reimbursable collaborations and support.

- *Mr. Levin* asked for clarification. *Ms. Vanhooser*: The oversight role for NASA through COTS and Commercial Crew Development (CCDev) is very different from doing analysis or tests for a company. We need to make sure we are not doing oversight on our own work, rather than providing a paid service for the commercial company.

- *Mr. Levin* saw that they may pay you from money NASA gave them. But, *Mr. Doering* said that where their money comes from is not relevant; it might be from the NASA funding to the partner, or from the partner's own

investments. Nevertheless, *Mr. Levin* was concerned that this wrinkle could create redundancy.

The purpose of the Flight Programs and Partnerships Office is to establish and facilitate relationships so partners get the technical agreements, pricing data, etc. they need to get an SAA through the system so they can start work. The office also works with internal people to help them understand the partner's requirements, and then follows up on that, ensuring that once we do the work so the customer is satisfied.

To get the word out and to help potential partners understand the capabilities available to them at Marshall and other NASA Centers, Marshall staff have convened "Support Industry Day" events; established a Web site so the community can access news releases, collaborative events, and partnership material and organizational contacts; and attended conferences.

- *Mr. Doering* clarified that Industry Days are advertised nationwide, but usually only attended by local people.

Commercial space partners that have active agreements or agreements in progress include: ATK, Blue Origin, Ball Aerospace, Orbital Sciences, TBE, Sierra Nevada, Space Ops, Aerojet, Virgin Galactic, PWR, ULA, Dynetics, Space X, Lockheed Martin, SAIC, Northrop Grumman, and Boeing. Capabilities to which they may have access include: Shuttle hardware, Ares software, loan of ground support equipment, facility lease and use, wind tunnel testing, expertise (e.g., in composites, propellants and propulsion technologies), engine design and testing, hybrid motors, or reaction control system (RCS) thrusters.

- *Mr. Levin* asked for the overall number of SAAs; the above list does not seem extensive. *Ms. Vanhooser* responded that the volume of applications that go through one central place is the sticking point. *Mr. Doering* added: Space Act Agreement Maker tracks all the agreements.

In summary, the Partnership Office is trying to make it easier for partners to work with Marshall to gain access to capabilities, facilities, and expertise. Marshall is committed to maintaining the capabilities that support core competencies. The biggest challenge is proof of unique capability. They are subject to many levels of checks, and it takes time to answer all the questions in the legal process—the goal of which is to protect NASA and the Centers.

- *Mr. Levin* wondered if it would save time for each Center do oversee its own SAA approval process. Is it the law that's the challenge or just that the process is time-consuming? *Ms. Vanhooser:* In the legal office, one person handles all SAA, so there is consistency. Based on the questions they ask, she thinks the problem is not throughput, but interpretation of the law. *Mr.*

Goldman agreed. Questions concern conflicts of interest and unfair competition, i.e., whether other companies offer the services this company seeks from Marshall. We are not used to questioning someone who comes with a requirement and a check. We need a roundtable to discuss handling these kinds of issues, so we can define a consistent approach. *Mr. Cabana* agreed that interpretation is the problem. Commercial partnerships are new to NASA, and we are trying to get better at it. It takes longer than you would like to get something new started. And, lawyers interpret the same things differently, so it takes time.

Mr. Levin sensed a political overlay in the requirement that NASA not compete with industry. *Mr. Goldman:* It is easier to say a facility is unique, but it is more difficult to prove that analytical and engineering services are. *Mr. Doering:* Marshall has a more liberal interpretation because it behooves us to get people in to divest ourselves of excess facilities. On the other hand, if NASA doesn't need it, getting rid of it is problematic—e.g., it may be part of another facility. *Mr. Cabana:* We need to reduce the number of facilities—some are old and have energy-consuming equipment. Our ultimate goal is to maintain capability for the US so we can continue to be a leader in space. We are working with the commercial community so we don't lose a critical engineering capability that NASA does not need at the moment but will in the future. *Mr. Doering* noted the difficult balance needed when keeping a building open that costs an inordinate amount to maintain, and leasing it to a commercial facility can help.

- *Mr. Stephenson* reminded participants that government was not established to be efficient, but to be effective. And, part of it entails the Center's understanding of how we can be profitable. *Ms. Smith* summed up: On many levels as this transition takes place, there are looming questions for which NASA has no experience.

Facilities—Mr. Bob Devlin, Office of Center Operations

Mr. Devlin began by noting that Marshall leads building reduction by 65%.

The Office of Center Operations is concerned with the 4 core products—Space Transportation/Launch Vehicle Technology and Development; Propulsion Systems Technology and Development; Space Systems Technology, Development, and Integration; and Scientific Research. They have traced 26 core capabilities to these core products, analyzed these capabilities and skills in detail, and mapped the capabilities to specific facilities. This study revealed 3 areas that need more work: large-scale manufacturing (at Michoud Cloud Facility; MAF); large instrument and optical system testing (XRCF); and Structural, Environmental, and Propulsion Testing.

Marshall has revised its facilities activities to accommodate NASA's changing mission. The 5 sites—Santa Susana, Alliant Techsystems (ATK), Solid Rocket Boosters (SRB)–Kennedy Space Center (KSC), MAF, and Marshall—contain a total of 422 buildings. Of these, about 225 are used for the Shuttle, Ares, or the International Space Station; 2 will be transferred; 33 are scheduled for demolition; and 39 will be mothballed.

"Current replacement value" is defined as what you would need to replace the facility if you built it now. How to dispose of the actual property is also a question. Things we think we will need in the future are either mothballed (which saves two-thirds of maintenance costs) or leased to commercial companies.

In addition to revising its workforce and technical capabilities to what is needed for the Agency's mission, Marshall is aligning its facilities with that mission.

- *Ms. Smith* asked about the age of the buildings at Santa Susana. *Mr. Devlin:* The Air Force had the property until the 1970s, and DoD owns some of it. The Government Services Administration (GSA) tracks replacement values. When the Base Realignment and Closure Act (BRAC) reduces sites, it is based partly on current replacement value. *Mr. Levin:* What is involved in the decision that you don't need a building anymore? *Mr. Devlin:* They need just one standardized metric. It costs the government about $550,000 for maintenance and future liability. When a space is declared excess, the first question is whether the Center needs it, then other Centers or the Agency, and then the community, e.g., Santa Susana's fire engines went to a local station, and the pressure vessels went to the Marines. All of this addresses finding a better way to do the work, a better way to do business. If we don't need a building, we get rid of it and realign our resources.

MAF Update—Mr. Steve Doering, Michoud Assembly Facility (MAF)

Michoud is a unique large-scale manufacturing-capable site contained in a 43-acre building with access to a deep-water port—a great transportation hub. The State of Louisiana has made a $62 million investment in it for advanced tooling to keep jobs in southern Louisiana. This has been transformed into a multi-project facility. They established a pricing policy for the facility (light and heavy manufacturing, etc., and also demand facilities, such as testing and paper). For each partnership, 2 agreements are needed, an SAA or EUL for facilities and an SAA for demand services (anything above and beyond occupancy). They recently established a third-party management capability, which has resulted in >30% reduction in facility operations costs. This is of great importance in getting costs comparable with market rates—we don't want to overcharge or to undercut the market—and reduce operating costs to NASA.

- *Mr. Levin*'s asked why Marshall is running this facility that is located in Louisiana, rather than MAF being its own center. *Mr. Goldman* clarified that

Marshall was responsible for Apollo launch vehicles, so Marshall has a history of doing large propulsion.

MAF's innovative business model encompasses multiple programs in the facility, both commercial and government tenants, and turn-key manufacturing. The Orion Multi-Purpose Crew Vehicle (MPCV) is being manufactured in the facility, and they are now building the primary structure and composite panels for the Space Launch System (SLS).

The workforce on site totals about 2600, down from about 3800; excluding the transient workforce, e.g., day laborers for movie production. Movie production leases with Longbranch Studios for example bring in $1 million to $2 million per year. Current agreements with the production companies are for 6 months or less, but they are in the process of drafting a 10-year EUL. Coast Guard and EPA offices focused on the Gulf of Mexico have moved to the site. In all, MAF has executed 12 new SAA with 37 modifications to existing SAA, representing some $15.5 million; and 4 EUL. These offset costs to NASA by 16%.

The same forces that impede others from getting things through the bureaucracy are also experienced by MAF. Scrutiny from Headquarters is the biggest challenge. The MAF partnership with the State of Louisiana has been successful, and they have identified >300 potential prospects. B-K Manufacturing is the third-party company brought in. British Petroleum is another example—Marshall supported the Deepwater Horizon investigation, which is winding down; now they will store the evidence at MAF for the duration of the trial. One building will be turned over to USDA.

- *Ms. Smith* asked whether legislative regulations needed revision to better suit these activities. *Mr. Doering:* MAF needs 2 things—the ability to charge at market rate, i.e., less than full cost; and the ability to put demand services on an EUL. *Mr. Cabana* added that every year NASA has a call for legislation to Congress, and it would be useful to have access to past requests.

Briefing: Overview of Kennedy Space Center's Commercial Space Activities and Plans

Mr. Robert Cabana, Director, Kennedy Space Center

The number of SAA is not a fair metric: KSC has 200, but they are actually actively working with companies to do work on only 35. KSC has always depended on a large government program—Apollo, the Space Shuttle, etc. With the retirement of the Shuttle Program, commercial space has become very important to KSC's future. At the peak of work on Apollo, KSC had a workforce of some 25,000, at the peak of

Shuttle work, it had 18,000. That has been reduced to 7500 contractors and civil servants at present.

- *Ms. Smith* asked how they determine what the build-up should be.
  Mr. Cabana: It depends on the kind of work that comes in. We want to maintain core skills, and similar skills will be needed for the 2017 and 2021 SLS launches as were needed for past projects. It is more efficient to bring in commercial projects that require those same skills. The challenge is maintaining those skills when you have no immediate need for them. So, the skills a prospective commercial partner wants must be space-related.

When Constellation was cancelled, it created many problems across the Agency. Many of those employees are now working on the SLS program, and they see that we have to make commercial space viable and they are looking for ways to develop that. We have to have partnerships to make this viable—it is too expensive to do alone.

KSC's 2 goals are to ensure mission success by enabling government access to space, and to inspire the nation's future explorers' capabilities to make accessing space less costly and more routine. And, we have a path forward to make that happen. KSC's core competencies are in launch services and commercial crew development, but it is more than just a launch complex; the focus is also on vehicle recovery. Government systems include the Orion MPCV, and the SLS heavy-lift booster.

The vehicle assembly building, which has 4 bays, cannot be used to support one launch every few years, so they are making it available to commercial customers. Potential commercial systems include: existing evolved expendable launch vehicles and heavy-lift derivatives (Delta IV and Atlas V), Falcon launch vehicles, suborbital reusable launch vehicles, horizontally launched systems, and new technology vehicles. Wire harnesses they built are being tested. The high bay where they tested the Apollo spacecraft is where they will build Orion. (The bay was built for Constellation, but when that program was cancelled, Orion stayed there as the MPCV.) KSC's goal is to be ready with its ground systems when the SLS rocket comes.

- *Mr. Levin* noted that the program brought 300 jobs to the State of Florida.
  Mr. Doering: But, the only guarantee is when people are brought for a certain job.

Technology capabilities include CRYOTE liquid storage and transfer; RESOLVE, which will go to the Moon and drill samples; Solar Field, an agreement with Florida Solar Power and Light (one of the first EUL in the Agency); SPHERES propellant slosh test-bed; and the VEGGIE growth unit. The new building at KSC generates more power on the grid than it uses in a 24-hour cycle, so they wind up getting electricity free.

The Launch Services Program (LSP) vision is to be the recognized leader in launch services. Its mission is leadership and expertise in providing on-orbit, on-time, on-cost launch services. LSP plans several launches in 2012–2014.

The Commercial Crew Program (CCP) is a KSC/Johnson Space Center (JSC) partnership with the program office at KSC, and the Deputy Program Manager at JSC. Initial capability is slated for the middle of the decade, depending on funding. Current CCP partners with funded SAA are Blue Origin, Boeing, Sierra Nevada, and SpaceX. Three more partners--ATK, Excalibur Almaz, and ULA—have unfunded SAAs. These SAA are separate from agreements the companies may have with the Centers themselves.

The Ground Systems Development and Operations Program (GSDO) has 2 pads. Pad A still has Shuttle pad configuration for which they are seeking an SAA partner; Pad B is a clean pad offering flexible launch capability. The vehicle assembly building includes high-bay 3, which will support SLS, and high-bay 1, which is not needed and will be turned over to commercial use. Mobile launcher will be modified to use with SLS. GSDO's planned project investments are to convert the Shuttle Landing Facility for horizontal launch and landing, MPPF for MPCV and commercial use, CxP mobile launcher for SLS, LC-39 to support SLS and commercial use; and to modernize range infrastructure and develop command and control systems. KSC is the only place in the world that has this combination of experience, geographic advantages, and purpose-built infrastructure.

The Center Planning & Development Office is the "Front Door" to engage new business focusing on the master plan for KSC infrastructure, land use, and real estate. Facilities are being reutilized, e.g., in with KSC's partnership with the State of Florida, they built a life sciences laboratory, which has been turned back to Florida and KSC leases the labs they need. But, the Orbiter Processing Facility (OPF) 3 agreement is KSC's biggest success. The facility was turned over to the State of Florida through a 15-year use agreement. KSC cannot afford to maintain it or tear it down, so it became a commercial facility. In turn, Space Florida has an agreement to lease OPF 3 to Boeing for assembly and crew training, etc., and, if Boeing is not successful in the end, KSC retains a veto right for what company they bring to KSC. Exploration Park was enabled by an enhanced-use lease. It will move outside the KSC fence, and the State of Florida will make it into an industrial park.

Available facilities and assets are Launch Complex 39 area, Mobile Launcher, Mobile Launch Platforms, and the industrial area. The Shuttle Landing Facility is unique because it enables horizontal landing. One challenge will be cross waivers of liability when they have to protect blast areas, but commercial companies are accustomed to buying insurance to protect against that sort of thing.

Recognizing that commercial space is the future and space exploration is part of that future, KSC has worked hard on the transition, laying out a path and defining measurable goals to make commercial space a reality.

- Responding to *Dr. Harris, Mr. Cabana* said KSC's biggest problem is getting a business case that everyone will buy into. The building was paid for by Shuttle transition and retirement (T&R) funds (which equal the worth of the agreement), but the building entails a cost in maintenance. With a use agreement no funds change hands. At the end of 15 years, they have to tear the OPF3 building down and remediate the ground.

- *Mr. Doering:* The big argument at Headquarters was how they could be sure no one else wants to use the building. It is a difficult concept to give it to a single company and apparently not show preference to that single company. Mr. Cabana laid the groundwork for the other Centers. But, *Mr. Cabana* said, it was easier for him because he dealt with another government entity, the State of Florida. *Ms. Smith* asked about the requirements to circulate notices of availability. *Mr. Doering:* KSC has done this generically for a facility, but they do not update the notice when a particular company wants the space.

  Ms. Smith: Is the difficulty that notice of availability did not pertain to that particular property? *Mr. Doering:* It is a matter of interpretation. How do you know everyone has seen the notice? The Chief Counsel has to agree that no laws are being violated and all regulations are being met. *Mr. Levin:* So the ideal is to have state agreements; they can come up with needs, and it allows states to compete with one another. It is better for states to take the responsibility because they want to keep jobs in their states. *Mr. Cabana:* States can offer incentives that the federal government cannot offer, but states have to have an interest and be willing to do it, and it is still difficult because of the state's liability. The ideal would be to find a better way to allow commercial companies access to real and personal property inside these building. *Mr. Doering:* In addition, this differs by state. Nobody in the State of Louisiana would be willing to do this (an agreement like the State of Florida made for OPF3). They have no interest in assuming a significant liability over a long period, but they did enter into an agreement for the state university to buy equipment—it varies by facility and state. *Ms. Smith:* If Louisiana has no interest, it is already disadvantaged.

- *Mr. Cabana:* KSC has a tremendous agreement with the State of Florida because they did not want to lose the capability when the Shuttle Program ended. *Mr. Scheuermann:* No state is automatically interested—it is our job to find the balance of how much NASA helps them.

- *Dr. Harris*: The SAA structure is antiquated, but we have used it over time and it is consistent. Specifically, 5-year agreements are not realistic for

commercial companies, nor is the clause that says if the government needs the facility, the company must vacate within 90 days. These 2 clauses are not viable in the commercial world, although it is possible to sign as many as 5 5-year leases. *Mr. Doering:* The first EUL offered to Lockheed was for 10 1-year agreements, but they would not agree to it. *Dr. Harris:* Is there a process for looking at these policies? *Mr. Scheuermann* assured him that there is, and that the situation is better than it was. But, much of this was foreign to NASA, and we are learning how to enable these agreements. Often it is policy, not law. First, it goes through our own counsel and then the office of the Chief Financial Officer. *Mr. Cabana:* Centers make the SAA, but Headquarters must agree. A legislation change would be helpful to enable commercial space because Headquarters wouldn't have to look so closely at each agreement. *Mr. Levin* noted that legal expertise is already at the Centers.

Briefing: Overview of Stennis Space Center's Commercial Space Activities and Plans

Mr. Patrick Scheuermann, Director, Stennis Space Center

Stennis resulted from the vision of the people working on Apollo. It began as a subsidiary of Marshall and became a space center in 1988. To create the site, 5 Mississippi towns (with 668 families) were relocated. Its 140,000 acres create a huge buffer zone. They started in 1966 with the Saturn V testing, and now want to maximize the site's use with commercial projects. Stennis is America's largest rocket engine testing facility. Most important is not losing the acoustical buffer zone—this is the only place they can test big engines without disturbing the surrounding area and still be close to assembly areas. Engines and rocket segments can be sent to Stennis by barge.

- *Mr. Levin:* This facility is so unique that it will have to remain as long as the US is building rockets. *Mr. Scheuermann* agreed, but acknowledged that they still spend time fending off people who want the historical family land back despite previous compensation. Since 1961, the government has stood by the unique need. But, it's a buffer zone, not an exclusive-use zone, so you can farm it, cut timber, or hunt, but not build a habitable structure on it. The surrounding area was sparsely populated in the 1940s and 1950s, but not now. People occasionally call to complain when their windows break or their house foundation cracks.

The Stennis workforce reached some 5400 employees with Apollo in early 1970s of whom only 300 were civil servants needed to do institutional, legal, and procurement functions. No particular NASA program has been assigned to them; they are solely for customer support. It was created as the rocket test center, and

since 1988 they have been trying to create a one-stop shop for rocket testing, technology, and flight certification.

After the Apollo Program (1974), Stennis became a "unique federal city." NOAA has used Stennis, then the Navy, and now Stennis contains the US's largest concentration of oceanographers from more than 30 major federal, state, academic, and private organizations, and more than 60 technology-based companies. Academic institutions enable employees to receive advanced education on site. The location is ideal for rocket testing, coastal research, and Gulf of Mexico activities.

- *Mr. Trafton:* Some commercial companies have built their own test facilities.
  Mr. Scheuermann: People think they don't want to go to southern Mississippi, and we can't market and tight budgets prevent much travel, so Stennis' success is its best advertisement. We are talking to SpaceX about their next version because they are running into encroachment problems at their Texas facility as their rockets get bigger. *Mr. Cabana* added that many companies do not want to be tied to government schedules for when and how they can test and launch.
  Mr. Scheuermann: Nevertheless, eventually someone has to give the government stamp of approval that they can fly. And, for that, they need someone who can read and understand the data. *Ms. Smith:* It may be good that SpaceX is not there yet because it allows comparison.

The government owns the central 13,800-acre fee area, and has an easement on the 125,000-acre buffer zone. The easement prohibits building a habitable structure. The state works with Stennis to do things for the public good, e.g., establishing a science center. The site has a 7.5-mile Panama Canal-like lock-and-dam waterway system that links the Stennis test complex to the Pearl River. (Stennis' water level is higher than the Pearl River's.) Via the 2005 Defense Base Closure and Realignment (BRAC) Act, Stennis received an Army facility, which doubled their space, but it came with no money and no people to maintain it; they are working toward a plan.

Stennis' core competencies are: rocket propulsion testing, and applied science and technology. Beyond their regular mission, Stennis has skills to deal with manmade or natural disasters, e.g., Hurricane Katrina or the Deep Horizon oil spill. An EPA office was relocated to Stennis to aid in coastal remediation.

More recently, testing has been done for the J-2X engine, RS-68, AJ26, and the Space Shuttle main engine—all make a lot of noise. Blue Origin and Aerojet are now on site. Commercial testing has been done on TGV, TS-68, AJ-26, TRW 650K thrust chamber, 250K hybrid, and hydrogen peroxide. Stennis generally does not test solid fuels. (White Sands does that.)

The new A-3 test stand will allow engineers to test operating parameters of next-generation rocket engines by simulating conditions at various altitudes—a unique capability. The A-Complex capabilities were originally developed for Apollo, and

then used for the Space Station. Now A-1 and A-2 test stands are available. B-Complex tested the Delta IV. PWR manages the B-1 and B-2 test stands, but NASA maintains them. The next step is to provide independent test services for any partner.

- *Mr. Levin* summarized: From the beginning of Stennis until 2010, the people with flight-line responsibility also managed the engine. But now, they don't want to turn their engine responsibility over to PWR, so a civil servant is responsible for the tests. *Mr. Scheuermann:* PWR's proprietary system has been changed to a NASA system. From a Center growth perspective, getting into this role is a huge change, and one we thought we should have been in a long time ago. It's based on success.

The E-Complex is composed of smaller components, mostly commercial in the mid-1990s, e.g., TGV, IPD, 250-K hybrid, or the ET ice foam test. It is a one-stop shop for subscale idea tests to technology tests. E-2 Cell 1 capabilities allow use of existing government facilities for tests that would be expensive to duplicate elsewhere.

Stennis support facilities run things like the Cryogenic Propellant Storage Facility, High Pressure Industrial Water (a reservoir of coolant water), laboratories (environmental, gas and material analysis, measurement standards and calibration), shops, and utilities.

Stennis is part of the NASA Rocket Propulsion Test Program, which manages NASA's rocket propulsion test assets, activities, and resources. Each test program has its own characteristics. After Stennis tests a rocket, it is moved to KSC, and the next time it fires, there will be people riding on it.

- Responding to *Mr. Levin, Mr. Scheuermann* said there is a NASA clearing house, created in 1996, that only makes decisions for the capability of NASA. DoD and Air Force are separate. Mr. Levin has heard the criticism that the US hasn't advanced propulsion capability, but better testing should overcome that. *Mr. Scheuermann:* We are efficient at what we do for testing, but we are not so good at advertising what we do. *Mr. Goldman* pointed out that demand is an issue; not efficiency in propulsion design, particularly if no money is associated with the demand. *Mr. Cabana* added that there is also the requirement for liquid rockets, and we are developing the J-2X. It is not new technology, just improvements. *Mr. Levin* concluded that facilities are now available efficiently, but demand is limited.

Applied Science & Technology Project Office (ASTPO) responsibilities include managing the Gulf of Mexico Initiative for NASA Headquarters, federal co-lead of the Gulf of Mexico Alliance (a regional collaboration of the 5 US Gulf states and 13 federal agencies), and conducting scientific research that addresses the needs of the Gulf of Mexico region.

Stennis cooperative agreements include: the Center for Higher Learning (in which employees can obtain advanced degrees in management, science, computer science, and engineering), State of Mississippi and Louisiana technology transfer, and mutual aid for emergency response and natural disasters. Agreements are structured using SAA and subordinate agreements.

Area 9 was Army property that Stennis received in the BRAC process, but they got no money to operate it. However, PWR and a few other tenants, e.g., the Government Printing Office, are using the space. The State of Louisiana gave PWR $20 million for their enterprise there. Rolls Royce had an encroachment problem in England with their jet engine testing (similar to rocket engine skills) and in 2002 they moved R&D to Stennis. They needed a place where no one would ever encroach. Commander, Naval Meteorological and Oceanographic Command (CNMOC), NOAA, EPA, and Special Boat Team (SBT) 22 are all centered on coastal issues, and all have an office at Stennis. In addition, the Panama school that trained Navy Seals, and now all of Special Forces, has relocated to Stennis. Stennis also maintains partnerships with friendly countries to train there.

- *Mr. Scheuermann* clarified in response to *Dr. Harris* that Stennis is in charge of infrastructure to support all those things.

Briefing: Status of Commercial Orbital Transportation Services (COTS)

Mr. Alan Lindenmoyer, COTS Program Manager

This year is the culmination of a program that started 6 years ago, in 2005. After the first 50 years of human space flight, we had not seen growth similar to that seen in aviation. To achieve this growth, stimulating the commercial industry was critically important. COTS was an experiment begun with an investment of $500 million over 3 to 5 years. Constellation was begun at the same time and could have serviced the Space Station if need be. COTS was the back-up, but that changed over the years. This was the first time NASA used an SAA of this magnitude. COTS is as interested in emerging companies as in established companies, and they wanted to put as much money as they could in the hands of private companies. To do this, the legal community came together in an outstanding way and spent much time on the 3 different types of SAA.

Federal Aviation Administration (FAA) licensing, rights to data and property are all crafted to be commercial friendly. COTS objective is to promote the commercial space industry, which was amended into the original Space Act as a proactive step. They had to put structure around it to facilitate demonstration of capabilities to produce safe, reliable, cost-effective space transportation and create a market

environment that would sustain the new companies. In 2006 the first round of COTS awards went to SpaceX and Rocket Plane Kistler (RPK); no payment was to be transferred until NASA saw progress. Eventually, the RPK agreement was terminated, and a third company, Orbital, received an award in 2008. In December 2008, COTS awarded separate competed contracts to SpaceX and Orbital to service the Space Station by transporting cargo.

They had always envisioned transporting both cargo and crew, and, in 2010, NASA's $50 million in stimulus money allowed the first steps toward developing commercial crew: 5 companies competed and were awarded. There was a second round awarded in 2011, and now a third round for developing integrated systems is being competed. A change in management in 2011 separated the crew and cargo programs, so that now KSC handles crew, and the COTS Program at JSC handles cargo.

- To *Ms. Smith, Mr. Lindenmoyer* replied that COTS has not changed its approach to cargo, but the approach to crew has had different trends of thought. Crew is evolving and he is not sure where they are. *Ms. Smith* thought the new construct of NASA purchasing services for the government needs more clarity.

- To *Mr. Levin, Mr. Lindenmoyer* explained that the COTS Program is finished after the last milestone is completed.

SpaceX COTS Status
Since 2011, COTS has been the primary means for the US to resupply the Space Station, and they began to focus on what would reduce risk and increase their chance of success. SpaceX has completed 36 of 40 milestones. The remaining milestones consist of 2 demonstration of readiness reviews and 2 demonstration flights.

They have a new medium-class liquid fuel rocket, a Dragon capsule, and an entirely new launch site at Cape Canaveral. The Falcon 9 launch vehicle for the next demo flight has undergone a static fire test and the Merlin engines are installed. They developed new transport capabilities to truck the rocket to the launch site. Rather than load it on a flat-bed truck and carry it, the rocket itself is part of the transportation vehicle. The Dragon for the next demo flight has been tested (Thermal vacuum, electromagnetic interference, and hardware in the loop). This capsule has all the equipment needed to birth at the Space Station, including demonstration cargo for transfer.

- *Dr. Harris:* If the demo is successful, does that change the schedule for the Russians to deliver cargo etc? *Mr. Lindenmoyer:* We have already stopped purchasing Russian cargo resupply. The last Shuttle mission provided some margin for this year, and we have the European ATV.

Before any vehicle would be allowed to approach the Space Station, it must be proven that the vehicle can abort, has navigation capability, and can do free drift. Then it will be allowed to fly by under the Station, will be given permission to do it again, and on the fourth day to approach the Station.

COTS has been criticized for SpaceX's 2-year delay for the demos, but there were scope changes. Now there is skepticism as to whether this can be done as we now need it done more and more. SpaceX has met its recent milestones. April 30 is the target launch date.

Orbital COTS Status
Of 29 milestones, 24 have been completed. Last year we added a milestone for a maiden test flight, and the maiden flight and readiness reviews remain to be completed. Hardware is integrated at Wallops, where there is a horizontal integration station; Pathfinder testing will occur soon at the Wallops launch pad; and AJ-26 engine testing continues at Stennis. All engines required for the COTS demo have tested successfully.

Cygnus service modules are at Orbital's Dulles, VA facility, and the pressurized cargo module will come from Italy. Many recent delays for Orbital entailed finishing the pad at Wallops, which was more involved than anticipated. The cold flow tests at the pad and a hot-fire stage test will be done in May, and the maiden flight at end of June. The demo flight to the Space Station is planned for the end of September.

- *Ms. Smith:* What are the differences between how these 2 commercial operators and NASA work? *Mr. Lindenmoyer:* The most obvious is the quicker turnaround on decision-making and the bold resolution of the problems—they're going after them, reaching consensus within the company, deciding, and moving on. They have a very agile ability to turn-around decisions and move forward. However, both companies have high respect for NASA expertise. We have technical teams that work together every day, but NASA's role is advisory. Nevertheless, it is a 2-way learning experience. Decisions are made every day for liability and cost. Differences are also evident at board meeting and reviews. NASA is accustomed to being at the head of the table and directing, but that is not done here—we have much more of a peer relationship.

- *Mr. Trafton* asked about Orbital's reentry plan, but *Mr. Lindenmoyer* said they have none; the plan is to burn up on re-entry. The rationale was that they wanted to optimize cargo-carrying capability by using a heritage design. *Mr. Trafton* added that they aren't bringing back cargo, so they don't need parachutes.

- *Mr. Scheuermann:* We are not trying for a commercial crew under COTS. But, said
  Mr. Lindenmoyer, we have the option, however, for SpaceX to continue on COTS to a commercial crew.

- *Mr. Lindenmoyer:* NASA had no specific mission requirements, so the contractor had maximum flexibility. One thing that came up was inability to provide government furnished equipment (GFE). They did not know about the limitation of not buying anything, as a purchase requirement of the contract. Under the SAA they could not use a contract or sell things. The only way to transfer an asset was through the excess regulation. That needs to be changed.

Discussion

- *Mr. Trafton* summarized the problem of how to get an SAA through the system a little faster. *Mr. Levin* pointed out the need to define which of the 3 SAA we are talking about: funded, reimbursable, or non-reimbursable. The reimbursable is a challenge. *Mr. Doering* thought funded SAA were virtually impossible to get through the system. *Mr. Rathjen* added funded SAA are usually done through a competitive process. *Mr. Lindenmoyer* explained that funded SAA provide funding to a partner, whereas with reimbursable SAA, the partner reimburses NASA.

- *Mr. Doering:* A number of unfunded SAA have been made at Marshall. They want the memorandum-of-understanding framework that we agree to cooperate as soon as we know what you want us to do. It is when money is involved that a real contract begins. *Mr. Rathjen* said the process is the same for all 3 types of SAA. But, said *Mr. Doering,* the level of scrutiny differs when money is involved. *Dr. Harris:* With an unfunded SAA, do you need a new contract when money becomes involved? *Mr. Doering* does not do unfunded SAAs. There is much talk about the difficulty of effecting reimbursable SAA, but the situation is getting better. The issues are: old facilities, capabilities at the Agency as a whole, not impeding competition, being fair to everyone, and differences in philosophy about ensuring the protection of the Agency, which is the crux of the differences in interpretation.

- *Mr. Lindenmoyer:* Once it was established that using an SAA was preferable to a contract, everybody came onboard. *Mr. Doering:* In the COTS Program, the Agency made its decision. But, what he wants to do is different: He wants to enter into an agreement with Louisiana and Mississippi universities, which has not been done and opens a whole new discussion. This is fundamentally different from space rental.

- *Mr. Lindenmoyer:* NASA is one of the few agencies that has authority to enter into such agreements, so we have to be very careful. Also, there are 2 different "owners." FAR-based contracts are owned by Procurement, and SAAs are owned by the legal department, but we are trying to use the same format for both, so it is difficult.

- *Dr. Harris:* At the moment, are SAA the only way to enter into partnership agreements? *Mr. Lindenmoyer:* There are 2 tools: an SAA requires cost recovery and a 5-year limit; an EUL allows more than cost recovery and a 15-year agreement, but can be used only for leasing space, not demand-use.

- *Mr. Levin:* Are these for the facility only or also for the workers?
  Mr. Goldman: Most facilities would have to involve people who can run them safely for their purposes. *Mr. Doering:* At MAF, if we lease a facility, the facility operators are included, but not staff for other services, e.g., for testing, which would be a demand service and would come under an SAA.

- *Mr. Trafton:* Where does the 90-day requirement to repossess come from?
  Mr. Doering: Termination clauses in contracts differ by Center, which can choose from about 8 varieties in the template, but it has always been immediately and with no notice. We have tried to introduce flexibility, e.g., 18 months' notice. They have always dealt with companies that were used to dealing with NASA and knew that NASA cannot make decisions that fast, so the clause was largely ignored. However, Lockheed's defense sector refused to sign such an agreement, and now the clause has been relaxed. But, that is not legislated; it's done case by case. *Mr. Goldman:* The problem is that we are trying to use SAA in a manner in which they have never been used before. E.g., Rolls Royce is in the buffer zone, and at Stennis you have much more flexibility. They know the buffer zone will be maintained and that they are in a part of the facility that will never be used for anything else. *Mr. Doering:* During that negotiation, SLS was not being planned and they had no one to use the facilities.

- *Mr. Levin* summarized the day's discussions: NASA is changing, they have a number of facilities that are available, and those facilities can be used by commercial entities under an SAA. However, the question always arises, if the building can be used by a commercial entity, why is NASA not using it?
  Mr. Doering: It is one of the challenges to be managed every time because we have a federal mandate to decrease our footprint. We have to prove that there is a business case, and that tearing it down is not a better business case, or that we will need the facility in 10 years. We also have to prove that we are not unfairly aiding one part of industry at the expense of another.
  Mr. Goldman: But we have ways to make those decisions. The really troublesome concern is mothballing and keeping buildings in a condition in which they can be brought back to use. These buildings represent millions of

dollars of investment that we might have to walk away from. *Mr. Levin:* The environment we are in today has a chilling effect on bringing NASA some good ideas. We have to consider whether a suggestion will put something else on the list to be eliminated. *Mr. Goldman:* They're on the list already; but, when industry has a use it proves the worth of the facility. We need to find a way to advertise our capabilities, but we can't be in competition with industry for capabilities they also have.

- *Ms. Smith:* How do you accommodate the unanticipated? *Mr. Doering:* SLS did not plan to use building 303, so they leased it to Blade. Otherwise, they would probably have demolished the building. The lease also helps defer other operating costs. Headquarters has the same requirement to reduce its footprint. One building was scheduled to be torn down this year, but when a tenant needed it and the business case was shown, NASA deferred demolition. *Mr. Goldman:* In 1998, when they stopped doing B-1 testing, the facility remained idle, but when PWR started their work, they wanted that facility. They were the only customer for that stand (which was rusting away, and they were willing to rehabilitate it). For other buildings, we gave priority to customers who were already there.

Public Comments

- *Ed Goldstein, Orbital Sciences Corporation:* He's listening, but has no questions.
- No one else identified him- or herself.

Closing Remarks

Ms. Patti Grace Smith

Ms. Smith thanked the hosts and speakers for an excellent and informative meeting. She has heard a lot of healthy tension, and she sees the committee's role as one of helping to sort this out.

Adjourn

The open meeting adjourned at 2:30.